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THE VALUE AND SERVICE OF ZOOLOGICAL SCIENCE[1]

VALUE TO THE INDIVIDUAL

THE science of zoology is a body of organized knowledge, huge, impersonal, influential. Touching human concerns on many sides, it has been variously regarded: now as a pillar of philosophy, now as a handmaiden of esthetic, or again as a necessity alike to spiritual progress and to various indispensable achievements in the practical world. Powerful in itself, to other disciplines its contributions of hard fact and substantial theory have been many and in the aggregate profoundly significant.

Philosophies, however, are the creations of philosophers. The laws that we apply to diverse aspects of beauty we have framed ourselves. Eugenics and medicine, agricultural practise and the dogmas of religion—all are the works of the human imagination. As attention shifts thus from the product to the producer, an aspect of zoology is revealed that makes at once a more intimately personal appeal.

It is on this aspect that I would now focus your attention. Its appeal is to the individual human being apart from his professional, his vocational existence: to the plain person, pricked by a thousand impulses that must be encouraged and controlled; attended by obligations that must be measured and met; with opportunities for pleasure that he would do ill to lose; with opportunities for service that may carry him unfaltering to the cannon's mouth; ready to see in commonplaces the

[1] Symposium before the Zoological Society of America, Minneapolis, December 29, 1917.

wonders that provide him with motives for action; who, in short, must accommodate himself to a real world by practising the absorbing art of living.

It may not be amiss to enter somewhat more concretely into the life of this every-day individual. For not infrequently in the past has a large portion of his inumerable and varied wants been slighted by a training dominated by a more limited professional ideal.

These wants may be divided, for convenience of treatment, into three groups. Of the first group little need be said. It concerns the upkeep and repair of the human mechanism. It comprises obvious wants that are supplied by well-known rules of hygiene and regimentation, by personal habits and ordinary common sense; by agencies for the production and distribution of the necessaries of life; by food and sanitary inspection; by physicians; by the growing round of organizations for social welfare that aim to care for the individual whatever he may do or be able to do for himself. The satisfaction of these wants comes thus in the routine of civilized life—a routine in which, it is unnecessary to point out, zoology plays an ample part.

In the second group may be placed the less obvious and immediate necessities of citizenship—opinions that must be formulated, judgments that must be made, actions that must be directed toward advantageous social and political ends. How will the voter decide such issues as meat inspection, vivisection, compulsory vaccination, sterilization of the unfit, commitment laws for mental defectives, treatment of criminals, prostitution, marriage? What appropriations will he advocate in support of measures for the public health, including the reportability of venereal diseases? What proportion of the community income will he wish to have expended for the schools? And what, indeed will be his ideas of the functions that the schools of his district should perform?

To such questions may be added others dealing with international intercourse, with the mixing of races, with the tremendous problems of making war and keeping the peace.

These are but stray samples of the manifold human interests that zoology touches firmly, inevitably. If there be teachers of zoology who dwell upon phases of the subject that are not wont to facilitate such implications as these, is it perhaps because the subject rather than what it may do for the individual is receiving the major part of their attention?

In the third group the wants are more subtle, intimate and personal than any thus far considered. Here belong what are called questiōns of principle and morality; the judgments of motive that must be made, the interpretations of conduct that must be risked, where facts are blurred and honest opinions differ. With these go a multitude of appreciations—of philosophy and art and out-of-doors—of spiritual values and economic results. For, in so far as zoology has contributed toward the development of sound theory in another field, will it be indispensable for the appreciation of that which it has helped to create.

Here we may consider also man's emotional life—his pains and pleasures, his predilections and prejudices, his indifferences, his peculiarities of behavior; and along with these, his countless individual adaptations to the changing conditions of social and family life, where understanding deserves an exalted station to which, in practise, it does not always attain.

There is no need to continue this enumeration of the problems which, sooner or

later, appear in the course of every normal human existence. Nor is it necessary to point out either their dominating importance or the fact that, in the efficient life, they must be met, frankly, successfully.

What is zoology able to contribute toward this end?

Our answer to this question will depend upon what we conceive zoology to be. Owing to the modern tendency toward specialization in the biological sciences, existing conceptions do not form a very compact and homogeneous mass. I shall not take time carefully to discriminate them, however; since they differ for the most part by limitation only. They exhibit varying degrees of incompleteness. One no longer expects morphologists and physiologists, taxonomists and experimental embryologists to agree on a common definition of their common subject. This may be a weakness of the professional attitude; or it may not. But a definition that will include all that these varieties of zoologist might severally propose, will be clear enough for the present discussion. At the same time, it will be sufficiently broad. Though common ground may not be occupied, common limits may thus be set.

Thus defined, zoology exhibits certain attributes that are possessed in common with the basic inorganic sciences, physics and chemistry; and certain other attributes that pertain in general to it alone. Like physics and chemistry, zoology is an organized body of facts and hypotheses developed by the inductive method, and safeguarded by processes of verification that become more rigorous and searching in each science as it develops. Like them, though in less degree, it is an experimental science; and aspires to a closer kinship with them by virtue of the recent increased interest in quantitative methods.

So far, the inorganic sciences and zoology are essentially similar. As soon, however, as the question of content arises, a significant difference appears. For the facts of zoology, though they rest ultimately on a physico-chemical substratum, present as a rule aspects so unlike the customary phenomena of the inorganic world as to produce far different effects upon the imagination. It is a truism that the imagination takes its color from experience. But it is none the less important because of that. Indeed, it is for this very reason that neither physics nor chemistry nor both together can be an adequate substitute for zoology as an aid in the solution of the diverse human problems that have been noted above. Man is an animal; one species among a hundred thousand; one living mechanism among countless millions, controlled by the same factors at bottom that control them all. These, however, are not generally recognized facts. For man is also a mechanism of a complexity that baffles his understanding and confuses his theories of control. Though himself a unit of the living world, his conduct appears to have been strangely free from the influence of a biological point of view. He has written treatises on philosophy that, exhibiting a commendable knowledge of Newtonian mechanics, commonly show no comparable sign of biological experience. His art criticism is as yet dominated by a literary tradition from which it only exceptionally frees itself by some innovation as refreshing as it is rare. Religion has always been slow to adopt the demonstrations of science, especially those that touch her traditions most intimately. Rules and dogmas readily usurp the functions of facts. This is amply true in the pedagogy of zoology itself. Real values here are still matters of varying opinion. The reason is in all cases essen-

tially the same. The differences spring from differences of imagination; which go back to differences of effective experience; which can be expressed, on the whole, in terms of relative ignorance.

One obvious avenue of relief from the general situation lies through the common schools. The inertia of tradition and the embarrassing difficulties inherent in the complexity of the human mechanism and its multiplicity of external relations can be advantageously attacked by beginning early in the individual life the development of a biological point of view. If facts are furnished, not withheld; if teachers recognize the persistent danger of standing between pupils and their wholesome interests; if children are permitted to think candidly about natural processes; if they are encouraged to appreciate the dignity of naked facts, to believe that it is no discredit to a fact that it is true; results will flow in the right direction.

Another avenue of relief that concerns us as college teachers more closely, lies through the courses of zoology, especially the general courses, that are being offered by our colleges. If the common schools accept their opportunities and responsibilities, ours are not thereby lessened. What are the functions of the colleges in this connection? What is the nature of the material that zoology offers them for their use? I shall consider the second question first.

In the first place, zoology offers facts that are of immediate practical utility in a thousand ways, facts that are associated commonly with the technic of vocations, and facts that are neither the one nor the other. There may be no fundamental differences between the facts thus classified. For the character of a fact can not be altered by the accident of its immediate applicability. In certain respects, however, the classes themselves differ. The first and second are small, specialized and circumscribed in comparison with the much larger, more diversified and expansive third. They make a more limited appeal to the imagination. They confine it, setting limits to its flights before it has tried its wings. For this reason, and this reason only, I contemplate with some reserve the recent mushroom growth of vocational courses in our secondary schools, with the substitutions they usually entail; although, regarded as protests against a certain detachment from the concerns of every-day life which zoology has been known to assume in the past, they possess merit.

However that may be, and however the facts themselves may be classified, as a whole they embody certain conceptions that are characteristic of organic as contrasted with inorganic science; for example, the living organism, growth, development, evolution, behavior, adaptability. These are all vivid, dynamic conceptions. They stress movement, change, the process rather than the result, the activities of organisms living rather than their architecture dead; in all cases, the reference of data to dynamic standards, such as the interpretation, for example, of structure in terms of function. Thus, a cat's leg, as a collection of bones and muscles, nerves and blood vessels, lacks the significance which as a living moving appendage it possesses. Yet it must be dissected if its beautifully coordinated movements are to be adequately appreciated. It must appear transparent to the mind's eye. Function and structure stand thus in an indispensable relation to each other. But there remains this difference between them, that while structures have no meaning apart from their activities, the latter apart from the former have meaning without significance. Physiology

and morphology necessarily march hand in hand; though I am of the opinion that for the fullest development of the interests of the individual, the former should set the pace.

In the second place, the facts of zoology fill a vast and varied domain that extends from physics and chemistry, on the one hand, to sociology and psychology, on the other. They concern life in its most elementary aspects and its most complex and subtle manifestations as well. They record the limits of our knowledge of the physiological mechanism, contributing at once to the analysis of the behavior of paramecium and the instinctive, even the rational life of man.

For purposes of intensive cultivation, this domain has been broken up into many subdivisions. All of these have prospered; in some cases to such an extent that, absorbed in their own immediately enticing concerns, their stewards have lapsed into a certain forgetfulness of their neighbors. This is a normal accompaniment of specialization. But it can hardly be said to be desirable either for the development of the science as a whole or for the individual who may chance to come within range of its influence. Such individuals there are, however, preparing in our graduate schools to teach zoology to the elementary students of the next generation: students of cellular biology, perhaps, who are frankly uninterested in animal behavior; or students of animal behavior to whom genetics is but a name; or students of genetics who neglect comparative anatomy; or comparative anatomists who care nothing for cellular biology. As special workers they will fit somewhere into the professional machine. As teachers of the future, they can promise the elementary student no more than they themselves possess. Which is a pity, when zoology has so much to offer.

In the third place, zoology is growing with great rapidity. It is a youthful science. The great mass of its resources are as yet undiscovered, though they lie everywhere about us. With a large and growing literature, its rewards are as yet not primarily for the bookish. They may be had by any alert and active mind. There is a fine democracy in the opportunity it offers. Its secrets may be bared by old or young. Though years of technical preparation are required by some types of problem, little or no technic is necessary for the solution of others that are well worth any one's trouble and time. The frontiers of zoology are constantly shifting. The written record is constantly being revised. This rapid growth brings movement, novelty, wholesome stimulation.

As a consequence, in the fourth place, zoology presents peculiar advantages to the elementary student in school or college, for the use of the constructive imagination. From the beginning he may develop his instinct for workmanship on problems that belong to the fabric of the world's work. From the beginning he may face issues that are not merely conjured out of his ignorance but are issues in the learned world as well. And he may contribute directly toward bringing them to an end. In zoology he may return to a wholesome apprenticeship as in the days when students were the assistants of their masters, shared their hopes and ambitions and felt the stimulus of their creative activity.

That is to say, he may if it is permitted. The subject invites, problems await him, problems that he can make his own and that thus stimulate the invention of methods, careful observations, discriminations of significant details in otherwise dead facts.

The subtle lure of discovery is here, and the dignity of personal achievement. The spirit of research is here, to transform the drudgery of soulless routine into the excitement of self-realization. High enthusiasms are here, moments of strong emotion and lofty aspiration.

This is all to be had, if it is permitted. There are reasons why it is not always permitted. Sometimes they are reasons of calculated educational policy, more often of administrative expediency. But what is of far more importance than the reasons to the individual student are the courses he is permitted to elect. It is profoundly unfortunate if he feels, on entering the zoological laboratory, that he has somehow lost his intellectual freedom, that he has been shorn of his initiative, that what is henceforth expected of him is a docile and orderly record of certain selected observations that he is directed to make.

Such cases occur, though exceptionally. That they do not occur more commonly is because the habit of docile indifference has already been acquired in the preparatory years. The pupil has frequently learned, like the Prussian soldier, to think by command only. He is ready to do what he is told to do. He is helpless when not told. He regards the instructor as a taskmaster, and the laboratory as a drill ground where his own responsibility is reduced to the minimum, where personal desires are of no practical value, but where it is useful, with a view to graduation, to be silent and obey.

We all recognize the deplorable type. Do we accept it? I am sure that we do not. For if we should, the little good that zoology might accomplish in the individual life under such circumstances would be negligible in proportion to the wastage that would surround it.

If we do not, what then?

One plan of action at least may be suggested of the many that are doubtless in practise among you. It would adopt all necessary measures to save the student's initiative, quicken his imagination, teach him the trick of invention, make a true researcher of him, if you will, in spirit. It would insist that each student regard the laboratory as his workshop where, with the facilities to be obtained there, he may think out and solve his own problems. It would set no conventional boundaries to the laboratory, which would best be considered the place where the student happened to be at work, whether in the college laboratory proper, or in the field, or at home. But it would stipulate that he do not come to the laboratory empty-minded; that he bring an inquiry that could best be investigated there, and that he develop the investigation with all due regard to care in observation, logic in thought, clearness and significance in record. The immediate environment would be the primary source of his material. Laboratory manuals would be limited to necessary technical directions. The classroom would serve for the discussion of principles, the formulation of problems, the criticism of results and the connection between it and the laboratory and the library be made as intimate and practical and workmanlike as possible.

In some such way the colleges might discharge a portion of their tacit obligation to place zoology in fullest measure at the service of the individual citizen, for the satisfaction of those wants that pertain to his personal life, whatever his vocational interests. Indeed, it is to the colleges especially that he must look for this help. For the colleges produce the teachers of zoology the country over. And the teachers touch the public with an intimacy of contact that is their privilege alone.

Harry Beal Torrey

Reed College

UTILITARIAN VALUES OF ZOOLOGICAL SCIENCE[1]

I HAVE been asked to contribute my bit to the symposium on the value and service of zoological science by discussing the utilitarian aspects of the subject. The first procedure is, naturally, to inquire into just what we mean by utilitarian. Utilitarian, that is, useful! Useful for what?

If we restrict the meaning of utility to service in filling our pockets or our stomachs, or in protecting ourselves and our possessions from various dangers, in other words, to economic phases of the subject—and I suspect that this is what I am intended to do—then I can not pass on to my more specific assignment without the parting protest that valuable as are the economic applications of zoology, I would rank them as far subordinate to the part that this science has played in widening the intellectual horizon of man and, notably, in helping to cast out from the human mind the twin devils of superstition and ignorance. The firm establishment of the theory of organic evolution is in itself perhaps the greatest event in the development of human knowledge. Not only has it clarified and made significant the uttermost limits of biological science, but its unifying principles have irradiated into all other sciences. Its spirit has pervaded and rationalized the whole realm of human thought.

Before passing to the economic aspects of the science I would also call attention to its unsurpassed value as a means of educational discipline. Somewhere in our educational scheme students should be taught to weigh evidence, in order that they may learn to deal adequately with facts and to evaluate the conclusions of others. This ability can be gained only by actual practise. And nowhere outside of zoology can we, with as little expenditure of effort, find better materials for training in the fundamental processes of observation, perception of relations and inference. Nowhere are there greater opportunities for developing that questioning, impartial, problem-solving attitude of mind which must obtain, if truth and sanity are to rule the world.

But coming now to the more conventional conception of utility as distinct from abstract truth, beauty or the refinements of existence, the science of zoology can boast a proud record of helpfulness in the practical affairs of life, and can point to a lusty brood of economic offspring.

During the past twenty-five or thirty years, in order to justify our existence, however, as professional zoologists we have had to call the roll of these so frequently, that most of you already know the list by heart and can not look forward to its rehersal anew with much but ennui. I shall endeavor, therefore, to make the story as mercifully short as possible.

1. *In Relation to Health and Disease.*—Perhaps it is in the realm of health and disease that some of the most obvious utilizations of zoological knowledge and zoological materials are evident to-day. While our first thought flashes bacteriology before us as the science *par excellence* in medical advancement, we must not forget that bacteriological progress has been and is inseparably linked with animal experimentation, that the great studies in immunity, or on the pharmacological action of drugs are essentially studies in animal life, and that more and more diseases are being shown to be of animal origin or conveyance.

Disease, plague and famine are all biological problems, and the great science of medicine itself is essentially a branch of applied biology. Medicine passed from the

[1] Symposium of the Zoological Society of America, Minneapolis, December 29, 1917.

realm of demonology, incantations, amulets and miasmas, hand in hand with advancing zoological knowledge. The members of the great sister societies meeting with us here to-day, ostensibly as allied medical devotees, are nothing in the world but camouflaged zoologists. For proof of my statement you need look only at the program of the so-called Anatomists. Have they not outdone the Zoologists themselves in presenting a purely zoological program? Moreover it is one which can not even be appreciated without considerable background of zoological knowledge. Contemplating the Zoologist's and the Anatomist's programs side by side, I am reminded of that foolish bit of verse attributed to Bill Nye,

> The Autumn leaves is fallin', is fallin' everywhere,
> Is fallin' through the atmosphere, and likewise through the air.

Can any one here, even with a Taschiro's biometer, detect a difference between the anatomical atmosphere of the one program and the zoological air of the other?

Next glance at the program of the Physiologists or of any of the other affiliated societies and does not a somewhat similar condition exist? In all of these are we not merely looking through different windows at the common science of zoology? Is not an acquaintance with the fundamental principles of the latter the most logical and direct approach to any one of them?

The study of zoology not only gives the beginning medical student practical skill in preparing for the study of the human body, but it also supplies him with a fund of conceptions and develops an attitude of mind that should be of great service to him in all his future work. Acquaintance with a wide variety of animals has invariably proved a boon to physiologists, and knowledge of the life of any form throws reflected light upon human life.

If more specific reference is required to show the relation of zoological science to sanitation and medicine, then let me call attention to the fact that some of our most dread diseases are of animal origin. At once comes to mind such scourges as syphilis, sleeping sickness, malaria, various amebic diseases, hookworm infection, elephantiasis and other filarian diseases, spotted fever, relapsing fever and many other fevers. And where the malady itself is not directly attributable to an invading animal parasite, it is in many cases conveyed by animal carriers. For instances of this we have only to think of bubonic plague, yellow fever or typhoid fever.

So important has become the subject of animal parasites in relation to man and useful animals that not a few zoological departments in our larger universities have thriving courses in animal parasitology. These are elected not only by prospective medical students but by agricultural and veterinarian students and by practically all who expect to go into any branch of economic zoology. Even students of plant pathology are finding that they have to look beyond their rusts, smuts, molds and bacteria, and learn something of nematodes, soil protozoa and other animal forms.

2. *In Agriculture, Animal Husbandry and Related Interests.*—Possibly even more conspicuous than in medicine are the applications which have been made of zoological knowledge to the field of agriculture and related interests. When we realize that injurious insects alone cause an annual loss in the United States of well over a billion of dollars, and that with proper knowledge of insect life and intelligent application of this knowledge, probably at least half of the loss could be avoided, the importance of economic entomology is at once evident. And when we add to this the long list of disabilities and deaths of our common ani-

mals, poultry, fish and game due to infestation by animal parasites—protozoa, tapeworms, flukes, threadworms, various insect larvæ and what not—we can realize that to cope with these pests successfully requires no inconsiderable knowledge of zoological principles and zoological forms.

Where in science can one find more of thrilling interest than in our quest throughout the animal kingdom for friends which we may pit against our insect and other foes? This setting of one species to prey upon another, as of lady beetle on scale-insect, and the world-wide search for suitable predaceous forms which it involves, requires, of course, a thoroughgoing understanding of the life relations of animals in general.

The great field of economic zoology is demanding more and more workers, both in the service of the federal government and that of the various states. Now the call comes for a mammalogist or a practical ornithologist, next for some one to investigate an epidemic among fish, then a man to help fight horticultural or agricultural pests, or perhaps the demand is for a protector of forest trees, an inspector of nursery stock, a scientifically trained apiculturist to safeguard and foster the bee-keeping interests of the state, and so the list goes on.

Another phase of applied biology that is attracting much attention to-day is that of genetics as applied to our farm crops and farm animals. The very fact that departments of experimental breeding or genetics are being established in practically all of our agricultural colleges and experiment stations is sufficient commentary on the practical value of this kind of work.

3. *Conservation.*—The whole subject of conservation of natural resources is so prominently before us at present that it requires but passing mention here. The depletion of our lakes and streams, the destruction of our bird life, the extermination of our game, is a story well known to you all. It is obvious that, first of all, those who are to undertake the correction of these evils must be thoroughly informed. Intelligent management of the situation, suitable regulations and restorations require much knowledge of animal life in general, such as that possessed by well-trained economic zoologists. Lack of such knowledge is accountable for much of the inadequacy of the measures in vogue in many places to-day.

4. *Fisheries.*—Again, the practical bearing of zoological knowledge upon such industries as our fisheries is patent at first glance. When we consider that one season's catch of salmon will run more than 455,000,000 pounds, that the annual yield of whitefish is some 75,000,000 pounds, that the catch of herring will total above 3,000,000,000 individuals, and that the quantities of many other kinds of fish taken run into correspondingly large figures, it is evident that our fisheries are one of our most important sources of food. In dollars the aggregate must be an enormous sum. The Pacific coast catch of salmon alone may in a single season run over $25,000,000. The work being done by the United States Bureau of Fisheries with its thirty-six permanent hatcheries and nearly one hundred auxiliary stations, together with that of the various State Fish Commissions may legitimately be reckoned as economic zoology. There is increasing demand for adequately trained zoologists to enter this practical field. Since such work embraces not only fish, but includes the aiding and controlling of the industries which have to do with such forms as the oyster, the lobster, the shrimp, the crab, the clam, the fresh-water mussel, the sponge and other types, a good foundation of zoological knowledge is clearly nec-

essary for its successful prosecution. In spite of all efforts so far toward regulating seasons of operation and quantities of catch, and notwithstanding much aid by artificial propagation and the control of epidemic diseases, the supply in every field is diminishing. If we are to strike a balance short of extermination, it is evident that much important investigation remains yet to be done.

5. *As a Practical Foundation for Education and Philosophy.*—Animal behavior and comparative psychology constitute the most logical approach to the problems of human psychology. For complex as is the human mind, and artificial as is human society, it has at last been recognized that human processes, mental, neural or vegetative, are only special cases of the more generalized processes of lower animals. The fact is coming to be more and more appreciated that biological researches, biological methods and biological principles can be utilized to a much greater extent in solving the problems of psychology, child study, pedagogy, sociology, philosophy and ethics than they have been in the past. A thorough course in zoology, together with a good digest of the evidences and the factors of organic evolution, a review of our present knowledge of the principles of heredity, and an understanding of the recent work in animal behavior, would seem well nigh indispensable for balance and perspective in the fields of psychology, education and philosophy.

6. *Eugenics.*—Still another field which is of the greatest importance to human welfare, that of eugenics, is fundamentally linked with a knowledge of zoological principles. Practical eugenics, a subject upon which the very perpetuation of our national life depends, consists of the attempt to better the human race innately by an intelligent attitude toward marriage. And the keynote to the intelligence demanded in this connection is knowledge of the laws of heredity.

Since it is with the lower forms of life that we must do our experimenting to establish and test out these laws, and since a comprehension of all that is implied in heredity and its converse, variation, necessitates an understanding of fundamental principles that can be attained only through acquaintance with a considerable range of animal life, a preliminary training in general zoology becomes the soundest method of approach to this important field. A knowledge of different modes of life and development, and an understanding of the causes for the decay and extinction of races of animals, sheds direct light upon the present and the future of the human race, and should be the possession of every one who would see eugenics in its true relations.

7. *Public Support of Economic Measures.*—Lastly, I would urge, from the purely utilitarian standpoint if you please, the necessity of some knowledge of animal life and animal forms, and of their relation to human life and problems, on the part of the general public. The maintenance of regulations for sanitation, for the conservation of natural resources and for similar undertakings, must be in large part a matter of intelligent cooperation of the public. This means that the public must be made to see the purpose of our endeavors and to understand the facts and principles upon which such cooperation is based. Before the average citizen will respect and promote our general economic regulations he must understand why restrictions on hunting and fishing are desirable, why pollution of water supplies is dangerous, why food-inspection, health-inspection, vaccination and quarantine are necessary, why he should approve of federal or state appro-

priations for the establishment of experiment stations, laboratories and the prosecution of many forms of scientific investigation, and nowhere can he get this information so effectively as through biological studies. The scientific ideas and ideals upon which such measures are based if once drilled into the student by concrete example and experiment will inevitably affect his conduct through all his future life. Public encouragement, or at least public tolerance, must exist before we can travel far in the application of biological principles to the welfare of the community or of the nation.

M. F. GUYER
UNIVERSITY OF WISCONSIN

SCIENTIFIC EVENTS

THE LAKE LABORATORY OF THE OHIO STATE UNIVERSITY

FOR the session of 1918 the Lake Laboratory will be located at Put-in-Bay, which is a beautiful harbor on South Bass Island in Lake Erie. This island lies about five miles off the south shore of Lake Erie and twenty miles north of Sandusky, Ohio. It is only a few hours by lake steamer from Cleveland, Toledo and Detroit. South Bass Island is one of the group of three Bass Islands, the others being Middle Bass and North Bass. Nearby are Green Island, Rattlesnake Island and several other smaller islands. This situation offers an excellent location for a Great Lakes biological station. Lake Erie is probably the richest in flora and fauna of any of the Great Lakes. The islands offer a varied environment of rocky shore, sandy beach and woodland. On the mainland, within easy reach, are extensive sand dunes, large marshes, woodlands and streams.

The laboratory will have quarters in the building of the fish hatchery operated by the state of Ohio. The second floor of this building furnishes ample room for lecture and table space. On the ground floor there are large aquaria and severa' tiers of hatching jars supplied with running water. The laboratory owns a small gasoline launch and rowboats. In addition to this the boats and field equipment of the Fish Hatchery will be available. There is a large boat which will enable workers to visit any part of Lake Erie.

If the change for this year from the former location at Cedar Point to Put-in-Bay proves to be advantageous it is hoped that eventually close relationships can be established with the fish cultural activities in Ohio. The state authorities are giving their hearty cooperation. The staff for the coming session will comprise Dr. F. H. Krecker, Ohio State University, Acting Director, who will give a course in ecology of aquatic animals; Dr. S. R. Williams, of Miami University, who will offer a course in the morphology of fresh-water invertebrates; Professor M. E. Stickney, of Denison University, who will have charge of the work in botany, and Professor Z. P. Metcalf, of North Carolina Agricultural College, who will give a course in entomology. Professor Herbert Osborn, research professor of Ohio State University, and Dr. R. C. Osburn, head of department zoology and entomology at Ohio State University, will be in attendance for parts of the session.

While the courses mentioned above are given for the benefit of those who may need them, the research activities of the laboratory are to be emphasized. Persons who may desire to engage in independent investigation of biological problems will be cordially welcomed. No fees will be charged such individuals unless for special equipment or materials supplied.

Comfortable living accommodations will be afforded in a furnished cottage adjoining the Fish Hatchery. Board will be given at cost.

The acting director, Dr. F. H. Krecker, will be glad to give any information desired. He should be addressed until June 15 at Ohio State University, Columbus, Ohio, after that time at Put-in-Bay, Ohio.

ANTI-TYPHOID INOCULATION

DR. W. W. KEEN has addressed the following letter to the Secretary of War:

In a four-page pamphlet entitled "Why Is My Soldier Sick," issued by the National Anti-vivisec-

tion Federation, with headquarters at 456 Fourth Avenue, New York City, are published two resolutions passed by the New York Anti-vivisection Society at its annual meeting January 31, 1918, and forwarded to you officially. The second resolution reads as follows:

Be it further resolved, That a copy of the foregoing resolution be forwarded to the Secretary of War as our official protest against the medical department's claim that serum inoculation is a necessary war measure and for that reason made compulsory, and as our protest against compulsory inoculation when the individual soldier conscientiously objects thereto; and we point to the provision of exemption now made by Great Britain, that power having been forced to rescind the rule of compulsion after the alarming effects of inoculation were disclosed.

It has long been a matter of common knowledge and deeply regretted by the medical profession that Great Britain has never made anti-typhoid vaccination compulsory, as it fortunately is in our own army.

In an article entitled "The Red Cross and the Anti-vivisectionists," a copy of which I am inclosing, I have shown by irrefutable facts how extraordinary the protection of the anti-typhoid vaccination has been in our own army and in the British army.

Although I knew that the statement in this resolution was an absolute falsehood, I preferred to have an authority which was beyond all question. Accordingly, on Saturday, April 27, I sent the following cable to Surgeon-General Goodwin, who occupies the same post in Great Britain that General Gorgas does in this country:

Surgeon-General Goodwin, War Office, London.
Has anti-typhoid vaccination ever been compulsory in British army?

Keen

To this on Monday, April 29, I have received the following reply:

London, Professor Keen, Philadelphia.
Anti-typhoid inoculation has never been compulsory in British army.

Goodwin

You will observe, therefore, that this is a flat countradiction of the false assertion of the New York Anti-vivisection Society.

Nearly all of the British army has been voluntarily vaccinated against typhoid fever. Colonel F. F. Russell, in Surgeon-General Gorgas' office, authorizes me to say that he understands that ninety-nine per cent. of the British soldiers are vaccinated against typhoid fever. The reason for this is that they have seen how extraordinarily complete is the protection offered by the anti-typhoid inoculation. At this time the fate of the war depends largely on the health of our army. It is in my opinion equivalent to disloyalty to deprive our soldiers of this protection and sacrifice their lives instead of the lives of a few rabbits, guinea pigs, cats and dogs.

Yours very respectfully,

W. W. Keen

THE SILLIMAN LECTURES

The Silliman Lectures at Yale University, to be delivered from May 21 to 29, will be based on seven of the twelve chapters contained in the anniversary number of the *American Journal of Science,* to be published about July 1. A Silliman lectureship volume, embracing the contents of this number, with some additions, will also be issued later by the Yale University Press. The lectures will be as follows:

I. The American Journal of Science from 1818 to 1918, by E. S. Dana. May 21, 4 P.M.

II. A Century of Geology—Historical Geology, by Charles Schuchert. May 22, 4 P.M.

III. A Century of Geology—The Growth of Knowledge of Earth Structure, by Joseph Barrell. May 23, 4 P.M.

IV. The Development of Vertebrate Paleontology, by Richard S. Lull. May 24, 8 P.M.

V. The Progress of Chemistry during the Past One Hundred Years, by Horace L. Wells. May 27, 4 P.M.

VI. A Century's Progress in Physics, by Leigh Page. May 28, 4 P.M.

VII. A Century of Zoology in America, by Wesley R. Coe. May 29, 4 P.M.

THE BALTIMORE MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The annual meeting of the American Association for the Advancement of Science and of the national scientific societies affiliated with it will be held at Baltimore, from December 27 to December 31. Boston had been selected as the place of meeting this year, action recommending that the meeting be held in that city having been taken at the meeting in New York City two years ago. In view, however, of war conditions and of the large number of scientific men now working at

Washington, it seemed desirable to select a place to which the amount of traveling would be reduced as much as possible, and where a meeting concerned with problems of national defense and national welfare could be held to best advantage. The situation was carefully considered at the meeting of the committee on policy held in Washington on April 22, and it was decided that it would be desirable to meet in Baltimore. President Goodnow and the professors of the scientific departments of the Johns Hopkins University having cordially welcomed the plan, it has been definitely decided that the meeting will be held in Baltimore. A committee consisting of the permanent secretary, Dr. L. O. Howard, Dr. W. J. Humphreys and Professor J. C. Merriam has been appointed to report on a general plan for a program that will make the meeting of the greatest possible service to the nation.

SCIENTIFIC NOTES AND NEWS

AT the annual meeting of the council of the Boston Society of Natural History, it was voted that the Walker Grand Honorary Prize, in the shape of a one-thousand-dollar Liberty bond, be awarded to Professor Jacques Loeb, of the Rockefeller Institute, New York, in recognition of his many published works covering a wide range of inquiry into the basic concepts of natural history. The Walker Grand Prize is awarded every five years, under the terms of the will of the late William Johnson Walker, "for such scientific investigation or discovery in natural history," first made known and published in the United States, as the council of the society shall deem deserving thereof.

AT the annual meeting of the Boston Society of Natural History, Professor Edward S. Morse, of Salem, was reelected president. He has been a member of the society for 60 years, and in point of seniority is exceeded only by President Emeritus Eliot of Harvard University. Other officers elected were: *Vice-Presidents,* Nathaniel T. Kidder, William F. Whitney, Charles F. Batchelder; *Secretary,* Glover M. Allen; *Treasurer,* William A. Jeffries; *Councillors for three years,* Reginald A. Daly, Merritt L. Fernald, William L. W. Field, George H. Parker, John C, Phillips, William M. Wheeler, Edward Wigglesworth, Miss M. A. Willcox. A single Walker prize, of sixty dollars, was awarded in the annual competition. The Prize essay was on "The Seasonal Distribution of Diatoms at Woods Hole, Massachusetts," by Miss Elizabeth D. Wuist, of the Osborn Botanical Laboratory, Yale University.

THE Franklin Institute has awarded its Howard N. Potts Gold Medal to Dr. A. E. Kennelly, of the Massachusetts Institute of Technology, Cambridge, Mass., for his original work on the hot-wire anemometer. The purpose of the device is to balance the heat produced by a measured current of electricity through a small wire against the cooling effect of a current of air, or other gas, moving across the wire. The same award was also made to Professor Louis Vessot King, of McGill University, Montreal, Canada, for his improvements in the hot-wire anemometer, his successful investigations of various physical problems, and for his making of this instrument a practical device for anemometry.

THE Academy of Sciences of Vienna has awarded the Baumgartner prize to Professor A. Einstein.

SIR AUREL STEIN has been awarded the Tchihatchef Prize of the Paris Academy of Sciences for his geographical work.

DEAN EDWARD M. FREEMAN, chief of the division of plant pathology and botany of the college of agriculture of the University of Minnesota, has been asked to become chairman of the agricultural committee of the National Research Council.

DR. RALPH ARNOLD, of Los Angeles, the geologist, has been appointed as a member of the Board of Tax Reviewers, in connection with the administration of the War Revenue Act.

DR. CHARLES F. BOLDUAN, director of the Bureau of Public Health Education of the Health Department of New York City, has resigned.

Professor J. H. Ransom, for eighteen years in charge of general chemistry in Purdue University, has resigned, his resignation to take effect at the close of the present academic year.

Dr. Elbert C. Lathrop has resigned his position as biochemist in the laboratory of soil fertility investigations, U. S. Department of Agriculture, to accept a research position with the Jackson laboratory of E. I. du Pont de Nemours and Company of Wilmington, Del.

Dr. John J. Tigert, head of the department of psychology of the University of Kentucky, has been granted leave of absence and will go at the close of this year to France into army Y. M. C. A. work.

Arthur Francis Buddington, A.B., M.S. (Brown, '13), Ph.D. (Princeton, '16), an instructor in the department of geology at Brown University, has been appointed a civilian instructor in the non-flying section of the aviation ground school at Princeton.

Professor Francis G. Benedict, director of the Carnegie Nutrition Laboratory in Boston, gave an address before the medical staff of the Base Hospital at Camp Devens, Ayer, Mass., on May 3, 1918, on the subject "The cost of overeating," based upon a research on undernutrition carried out with a group of twenty-five men at the International Y. M. C. A. College at Springfield, Mass.

Professor George A. Hulett, of Princeton University, gave recently a lecture on "Gas warfare" at the University of Minnesota.

Dr. J. A. Detlefsen, of the University of Illinois, gave the annual address at the meeting of the Kentucky Academy of Science on May 4, on recent developments in genetics.

A group of students of man have formed a "Galton Society" at New York City. A first meeting of the charter fellows took place at a dinner given by Professor H. F. Osborn, on April 17. The other charter members are Madison Grant, George S. Huntington, Charles B. Davenport, C. H. Merriam, William K. Gregory, J. H. McGregor, Edward L. Thorndike and Edwin G. Conklin. Additional members were elected as follows: Dr. Earnest A. Hooton, Gerrit S. Miller, Dr. Raymond Pearl, Dr. Frederick Tilney, Dr. Clark Wissler and Professor H. H. Wilder. It is proposed to elect more members from time to time up to twenty-five in number. Dr. Davenport was elected president and Dr. Gregory secretary.

The annual Norman Wait Harris Lectures at Northwestern University, which were founded to stimulate scientific research, have recently been given by Professor Thomas C. Chamberlin, head of the department of geology at the University of Chicago. The general subject of the course was "Glaciers, ancient and modern," and the individual subjects were "Birth, growth and mature stages of glaciers," "The decadence, death and residual products of glaciers," "Existing glaciation and the place it gives the present epoch in the cycle of climates." "The glaciation of the last geological period," "The glaciation of the earlier geological ages," and "The assigned causes of glacial periods; the climatic outlook." The six lectures were given on successive nights to large audiences, and a dinner in honor of the lecturer was given at the University Club of Evanston by the university trustees and members of the faculty.

A meeting of the Botanical Society of Washington was held on May 7. Abstracts of the papers presented will be published in the *Journal* of the Washington Academy of Sciences. The program was as follows: S. C. Stuntz: an appreciation: Dr. R. H. True. Collecting data on national forest range plants: Wm. A. Dayton. Nathaniel Jarvis Wyeth and his influence on western botany, with a sketch of his return trip from Oregon in 1833; W. W. Eggleston. Papain from Carica papaya grown in Florida: V. K. Chestnut.

Professor John Henry Comstock, professor emeritus of entomology, Cornell University, lectured before the Syracuse Chapter of Sigma Xi on April 1, on the habits of spiders, and on April 20, Professor Charles H. Richardson, head of the department of mineralogy, Syracuse University, lectured before the Cornell Chapter of Sigma Xi on coal mining with a camera. Both lectures were open to the

public. It is the intention of the two chapters to continue each year this exchange of lecturers.

MR. C. HANNEVIG has donated 150,000 crowns as a memorial to N. H. Abel. The income of the fund is to be used to further mathematical research in Norway.

THE death is announced of Dr. Emile Yung, professor of zoology in the University of Geneva.

THE American Association of Museums meets at Springfield, Massachusetts, on May 21 and 22.

THE Society for the Promotion of Engineering Education will meet at Northwestern University, Evanston, Ill., from June 26 to 29. The dormitories and fraternity houses at which members are to live and Swift Hall of Engineering at which the formal meetings of the society will be held are all on the shore of Lake Michigan in well-shaded grounds. The local committee hopes that its guests will, as a rule, use the late afternoon hours to get acquainted with each other in the open air on the shore of the lake and the committee will endeavor to make it pleasant for them to do so. There will be an informal meeting at the gymnasium on Wednesday evening and both the afternoon and evening of Friday will be devoted to an excursion on the north shore and a dinner at Ravinia Park.

ACCORDING to Director Edwin Brant Frost, of the Yerkes Observatory, the University of Chicago observers of the coming total eclipse of the sun have selected as their principal station Green River, Wyoming, a point on the Union Pacific Railway, lying between Cheyenne and Ogden. This station is situated in the so-called Red Desert, with a rainfall of about ten inches per year and at an elevation of over 6,000 feet. The remarkable transparency of the air in this region makes the station one of the most promising of any along the line of totality. The observing party from the University of Chicago will have about twenty members, including Professor Edward Emerson Barnard and Assistant Professors John A. Parkhurst and Storrs B. Barrett, besides volunteers from the Yerkes Observatory and other institutions. Some of the volunteers will use apparatus at Denver. It is hoped also that the weather will permit simultaneous observations with the spectroheliograph at the Yerkes Observatory by Dr. Oliver J. Lee.

THE Department of Terrestrial Magnetism of the Carnegie Institution of Washington, in accordance with a request from Captain Roald Amundsen, has supplied for use in his forthcoming Arctic expedition a complete set of magnetic instruments, as also the necessary directions for magnetic measurements and the program of work. Captain Amundsen plans to leave Norway next summer, and has made arrangements on the expectation that his expedition will require about five years for completion. He will make scientific observations of various kinds in the Arctic regions. During a visit by Dr. Nansen and Captain Amundsen to the laboratory of the department on April 5, the final details with regard to the contemplated Arctic magnetic observations were arranged.

WE learn from the *Journal* of the American Medical Association that seven prizes were distributed at the recent annual meeting of the National Academy of Medicine at Madrid, the prizes amounting to over 41,000 pesetas, about $8,200. The themes included vaccine therapy, medical geography and epidemics. One prize goes annually to the professor in the university who has contributed most to the progress of science, and one to a city physician, married and with children, who has sent in the best report on some epidemic.

"THE Organization of Thought," by A. N. Whitehead, reviewed in SCIENCE for February 15, 1918, by Professor C. J. Keyser, has now been published in the United States by the J. B. Lippincott Company of Philadelphia.

AT the request of the mayor of Middletown, Conn., Professor Charles E. A. Winslow, of the department of public health, Yale School of Medicine, assisted by David Greenberg and Ira D. Joel, of the same department, made a survey of health and sanitary conditions and the administration of the health service of

Middletown. The results and their recommendations have now been printed in a pamphlet with an introductory article by Professor Winslow.

UNIVERSITY AND EDUCATIONAL NEWS

Plans are announced for the establishment of a new college for political science in New York City, for which it is said that an annual income of $150,000 is largely secured. The faculty will elect not only the professors but also the trustees, and it is intended that the fullest freedom of teaching and of research shall be given to the professors.

Mr. William H. Porter, of New York, has given $50,000 to Middlebury College, to build a hospital.

By opening its school of medicine to women on the same terms as to men Washington University becomes coeducational in all its departments, similar change having been ordered a few weeks since in the school of dentistry.

It is announced that McGill University hereafter will admit women to the study of medicine and dentistry.

Dr. Herbert E. Hawkes, professor of mathematics, who has been acting dean of Columbia College during the absence on leave of Dr. F. P. Keppel, has been appointed by the trustees to be dean of the college, Dr. Keppel having resigned to accept the third assistant secretaryship of war.

Dr. Florian Cajori has resigned his position of dean of the department of engineering and professor of mathematics at Colorado College, and has accepted the appointment as professor of the history of mathematics in the University of California.

Professor Otto Glaser, of the University of Michigan, has been appointed professor of biology at Amherst College.

DISCUSSION AND CORRESPONDENCE

PROPOSED MAGNETIC AND ALLIED OBSERVATIONS DURING THE TOTAL SOLAR ECLIPSE OF JUNE 8, 1918

Special magnetic and allied observations will be made at various points inside and outside the shadow belt of the coming total solar eclipse, by the department of terrestrial magnetism of the Carnegie Institution of Washington, the Coast and Geodetic Survey, and some other institutions and individuals who have offered their cooperation.

The general scheme of work proposed by the Carnegie Institution Department of Terrestrial Magnetism embraces the following:

1. Simultaneous magnetic observations of any or all of the elements according to the instruments at the observer's disposal, every minute from June 8, 1918, 7 P.M. to 1 A.M., June 9, Greenwich civil mean time, or from June 8, 7^h to 13^h Greenwich astronomical mean time.

(To insure the highest degree of accuracy, the observer should begin work early enough to have everything in complete readiness in proper time. See precautions taken in previous eclipse work as described in the journal *Terrestrial Magnetism*, Vol. V., page 146, and Vol. VII., page 16. *Past experience has shown it to be essential that the same observer make the readings throughout the entire interval.*)

2. At magnetic observatories, all necessary precautions should be taken to insure that the self-recording instruments will be in good operation not only during the proposed interval but also for some time before and after, and eye-readings should be taken in addition wherever it is possible and convenient. (*It is recommended that, in general, the magnetograph be run on the usual speed throughout the interval, and that, if a change in recording speed be made, every precaution possible be taken to guard against instrumental changes likely to affect the continuity of the base line.*)

3. Atmospheric-electric observations should be made to the extent possible with the observer's equipment and personnel at his disposal.

4. Meteorological observations in accordance with the observer's equipment should be made at convenient periods (as short as possible) throughout the interval. It is suggested that, at least, temperature be read every fifth minute (directly after the magnetic reading for that minute).

5. Observers in the belt of totality are requested to take the magnetic reading every thirty seconds during the interval, 10 minutes before and 10 minutes after the time of totality, and to read temperature also every thirty seconds, between the magnetic readings.

It is hoped that full reports will be forwarded as soon as possible for publication in the journal of *Terrestrial Magnetism and Atmospheric Electricity*.

LOUIS A. BAUER

WASHINGTON,
May 8, 1918

PROGRESSIVE DEGLACIATION AND THE AMELIORATION OF CLIMATE

IN SCIENCE of March 1, 1918,[1] Professor Mather criticizes the interpretation of the writer regarding the corroborating evidence of Antarctic deglaciation as being indicative of the amelioration of climate which has been a cumulative, although variable, process since the culmination of the Ice Age. This retreat of Antarctic glaciation is not the only record upon which the writer based his interpretation. He also used "the greater and still more impressive evidence of the comparatively recent uncovering of temperate land areas."[2] Professor Mather appears to dissent also from the opinions of Scott,[3] Shackleton,[4] Taylor,[5] Ferrar[6] and David.[7]

These authorities, with every other explorer of these regions, make especial mention of the marked extent of the deglaciation which has recorded its extent from "south pole to Antarctic circle" (David).

Professor Mather would also wait for observations extending over centuries and omits to make note of the progressive deglaciation of temperate latitudes which has legibly recorded itself for several hundred centuries, within which time the glacial lake beds of Canada have become one of the world's richest grain fields. This evidence is more impressive and conclusive than the vast evidences in Antarctica where "the ice is everywhere retreating" (Scott).

Nor do discussions as to whether this deglaciation is due to wet or dry glaciers or to a possible decrease in precipitation add anything of moment to the great facts pointing to an amelioration of the climate of the earth so that it "is now warmer than it was during the episodes of extensive glaciation characterizing the Pleistocene Ice Age," this being due to the rewarming under solar control inaugurated at the culmination of that age.

The writer does not agree with the idea that the present distribution and development of climates is "abnormal," but holds that it is in the orderly development of climates passing from the conditions of "geological climates" into those of solar control; and also holds that present climatic tendencies and zonal control no more point to a possible return to the non-zonal distribution and control of geological climates than the present developments of life point to a redevelopment of the extinct orders of life of previous ages.

As to the climatic influence of carbonic acid generated by the combustion of fuels, carbonic acid has two narrow bands of almost complete absorption in that part of the spectrum limiting the wave-lengths emitted by the earth. These bands are at 4.5μ and 14.7μ. The first is in a region of very slight terrestrial radiation and therefore unimportant; the second is in a region of strong vapor absorption and there is sufficient water vapor in the air to completely cover this field. Since "the efficiency of the water vapor is several times that

[1] "Diminution of the Antarctic Ice Cap and the Amelioration of Climate," SCIENCE, N. S., Vol. 47, No. 1200, pp. 218–19.

[2] SCIENCE, N. S., Vol. 46, No. 1200, pp. 639–40.

[3] "The Voyage of the Discovery," Vol. II., pp. 416, 423, 424, 425. National Antarctic Expedition, 1900–1904, Vol. 1, p. 94. Scott's Last Expedition, Vol. II., p. 204.

[4] *Ib.*, pp. 286, 288.

[5] Address to Commonwealth Club, November 17, 1916.

[6] National Antarctic Expedition, Vol. I., 1900–1904, Report of H. T. Ferrar, A.M., F.G.S., geologist of the Expedition.

[7] *Geographical Journal*, Vol. XLIII., pp. 622–623.

of the dioxide[8] there is little left in this restricted field as water vapor covers the whole range of terrestrial radiation very effectively. Abbot and Fowle, after very elaborate studies and observations and a review of the available data on the subject, sum up as follows:

> It therefore does not appear possible that the presence or absence, or increase or decrease, of the carbonic acid contents of the air are likely to appreciably influence the temperature of the earth's surface.[9]

There is no evidence showing that the temperatures of the depths of the Atlantic ocean are affected by the salter waters of the Mediterranean Sea. The temperatures of the depths of the Mediterranean Sea are controlled by that of the Atlantic at the depth of the sill of the Straits of Gibraltar, over which there is an inflow into the Mediterranean to replace evaporation and surface outflow less about 30 inches of precipitation. The temperatures of the depths of the Atlantic are controlled by those of polar waters.[10]

The area of the Mediterranean and tributary seas is about 1,149,000 square miles; of polar oceans down to the parallels of 60 degrees about 187,890,000 square miles. The relative influence of Mediterranean outflow upon abysmal depths of the Atlantic, according to the conclusions of Professors Chamberlin and Salisbury, is probably negligible.

Marsden Manson

San Francisco, Calif.,
March 18, 1918

TRANSLATIONS MADE ACCESSIBLE

I read with much interest in the last number of your paper a communication from Mr. Burling regarding translations of foreign literature. If anything is contemplated in the way of a central bureau we would submit for your information that the Technical Section of the Canadian Pulp and Paper Association and the Technical Association of the Pulp and Paper Industry (U. S.) through their committees on Abstracts are publishing each week in *Paper*, New York, and the *Pulp and Paper Magazine* of Canada, Montreal, abstracts of the literature relating to this industry.

These abstracts include reviews of articles appearing in American, Canadian, British and Scandinavian Journals relating to pulp and paper-making, lumber and forestry and will in time embrace those in other languages when such periodicals are again available. The committees are ready to loan original copies of the periodicals reviewed and to supply translations where they are desired.

You are probably aware that *Industrial Management* of New York has a similar department relating to engineering and similar topics and that their organization is also prepared to supply translations of such articles.

J. N. Stephenson,
Chairman Committee on Abstracts,
Technical Section, C. P. & P. A.

A NEW CALENDAR

On April 16 Hon. J. M. C. Smith, of Michigan, introduced into Congress, at the request of Mr. C. W. Bennett of Coldwater, Michigan, a bill providing:

> That beginning with the year nineteen hundred and twenty each year shall have thirteen months of four weeks, or twenty-eight days each, the added month to be called Sol (from solstice) and to follow June.
>
> *Sec. 2.* That Monday shall be the first day of the week and the first, eighth, fifteenth and twenty-second days of every month; the other days of the week to follow in rotation by number, making Sunday the seventh day of the week and the seventh, fourteenth, twenty-first and twenty-eighth days of every month.
>
> *Sec. 3.* That the day following the last day of December, nineteen hundred and nineteen, and the last day of December in each subsequent year shall be called New Year Day. It shall be legal holiday, the first day of the new or following year, but not a part of January.
>
> *Sec. 4.* That in the year nineteen hundred and twenty and every fourth year thereafter shall be an extra day called Leap Day, to be placed between June and Sol, but not to be a part of either

[8] Chamberlain and Salisbury, "Geology," Vol. II., p. 672.

[9] *Ann. Astrophysical Obs. Smithsonian Institution*, Vol. II., pp. 172–73.

[10] Chamberlin and Salisbury, "Geology," Vol. II., 658–60.

month: *Provided*, That there shall be no Leap Day in the last year of any century that is not divisible by four.

A condensed statement of the facts relating to this calendar is as follows: The year consists of New Year's Day, which is the first day of the year, and is not a part of any week or month; and thirteen months of twenty-eight days each, as follows: January, February, March, April, May, June, Sol, July, August, September, October, November and December.

In centennial years divisible by 400 and in other years divisible by 4, an extra day, called Leap Day, is inserted between the months of June and Sol. Leap Day is not a part of any week or month. The first quarter of the year ends with the first week of April, the second quarter with the second week of Sol, the third with the third week of September, and the fourth with the fourth week of December. New Year's Day and Leap Day are holidays, and are omitted in counting interest and rent.

It might be an improvement in this calendar to have the week begin with Sunday, as has always been the case. The suggestion has also been made to give the extra month the name of Midyear, though these are matters of detail.

It appears to the writer that this calendar is more desirable than the one outlined by Professor Warren in the April 19 number of SCIENCE. I hope those who are interested in the matter will communicate with Congressman Smith and encourage him to push his laudable efforts in the matter.

W. J. SPILLMAN

DRAWINGS ON LANTERN SLIDES

TO THE EDITOR OF SCIENCE: In connection with the letter from Professor Gunthorp in your issue of April 12 in regard to drawings on lantern slides, I may mention that I have obtained satisfactory results with the use of ordinary India ink such as is used by draftsmen. This takes hold quite well on ordinary clean glass surface, I suppose through the action of the gum arabic contained in the ink. The slide can be attached to a drawing board by thumb tacks whose heads project over the glass, provided bits of rubber are placed between the glass and the heads of the tacks. For drawing circles with a compass a small bit of paper was gummed to the glass at the center, to enable the foot of the compass to take hold without slipping (the paper being afterward scraped off).

J. R. BENTON

SCIENTIFIC BOOKS

Culture and Ethnology. By ROBERT H. LOWIE, Ph.D., Associate Curator of Anthropology, American Museum of Natural History. New York, Douglas C. McMurtie. 1917.

Anthropologists in America need to issue more volumes for laymen than they have so far done. Dr. Lowie's present volume, and Dr. Wissler's larger volume on The American Indian, are especially welcome studies in this sparsely cultivated field.

Dr. Lowie says in his preface that his book is an attempt at popularization. Its aim is to occupy an intermediate position between technical discourses addressed to scientists and the more popular lectures which are designed to furnish mainly entertainment. In the first four chapters Dr. Lowie seems to me admirably to have attained his purpose.

The book starts with Tylor's well-known and practically perfect definition of culture: "Culture . . . is that complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society." The point is well made and forcibly driven home that since the science of psychology, even in its most modern and varied ramifications, "does not grapple with *acquired* mental traits nor with the influence of *society* on individual thought, feeling and will, there is need of a science which deals with all *acquired* capabilities and habits of man as a member of society." That science, as Dr. Lowie names it, is Ethnology.

In the discussion of "Culture and Race" the author grants that "at first blush" it appears very plausible that within the human species "differences in organization should be correlated with the observed cultural manifestations of varying degree and complexity." And he concludes that though we "assume that racial

differences *are* at the bottom of some of the observed cultural differences, this fact would not necessarily mean, then, that the *average* ability of the inferior races is less, but only that extreme variations of an advantageous character occur less frequently among them."

The field student of primitive peoples knows that not only do extreme advantageous variations occur less frequently among primitive peoples than among the more cultured groups numbering millions of men, but he knows that among primitive peoples artificial selection weeds out those superior individuals, who now and then appear and try to put over a new idea. The conclusion seems to me to be inevitable that this ruthless selection in time affects the racial hereditary abilities of such peoples—just as the Inquisition is known to have affected the Spaniards and Poles.

The author's conclusion in the chapter entitled "Culture and Environment" seems to me entirely too sweeping and to need many conditioning phrases:

"Environment can not explain culture because the identical environment is consistent with distinct cultures; because cultural traits persist from inertia in an unfavorable environment; because they do not develop where they would be of distinct advantage to a people; and because they may even disappear where one would least expect it on geographical principles." The discussion to a certain extent limits the sweeping reach of this conclusion.

In regard to "Determinants of Culture" Dr. Lowie truthfully says: "Psychology, social differences, geographical environment, have all proved inadequate for the interpretation of cultural phenomena. The inference is obvious. Culture is a thing *sui generis* which can be explained only in terms of itself." His conclusion is that culture is a closed system. Explanations of culture must remain on the cultural plane. "There are ultimate, irreducible facts, special functioning relations, and principles of wider scope that guide us through the chaotic maze of detail" in the science of human culture, as in all other sciences. Any particular cultural phenomenon is in a measure at least unique; and, in consequence, "its explanation will consist in referring it back to the particular circumstances that preceded it." One by one, then, cultural inventions must be studied primarily with reference solely to themselves; while the study of the growth of culture by diffusion from people to people, with accompanying modifications, will yield the larger volume of new data in the field of cultural research.

The last chapter, "Terms of Relationship," occupies eighty-two pages, or slightly less than one half the volume. By the time I had read the chapter two thirds through I turned to the conclusion for relief and light—and I was reassured of my powers of comprehension. This is Dr. Lowie's conclusion: "I am content with calling attention to the tremendous ethnological significance of kinship terminologies, with combating premature confidence in generalizations based on sheer ignorance, and above all with suggesting that the most rigorous logical formulation of problems is possible in this too long neglected domain of the science of culture." I was relieved to find that the often long-drawn arguments, the partial agreements with or refutations of, conclusions of other students of primitive culture, and the suggested relationships between kinship terminologies and cultural facts, were not intended to get the reader farther than Dr. Lowie's sane conclusion. I question the proper appearance of this chapter in a book intended primarily for laymen.

The book, on the whole, is a genuine asset to our anthropological literature, and will interest and enlighten the scientific student as well as the layman.

Albert Ernest Jenks
University of Minnesota

SPECIAL ARTICLES

NEZARA VIRIDULA AND KERNEL SPOT OF PECAN

The following is intended to serve merely as a preliminary note. The work to be done on the problem far exceeds what has been accomplished but the results obtained thus far are so striking that it has seemed worth while to

bring them to the attention of both entomologists and pathologists who might be interested.

Kernel spot has been reported by Rand[1] as a communicable disease. The same author isolated a fungus which he recorded as the causative agent, and described it as a new species (*Coniothyrium caryogenum* Rand). Otherwise little or nothing has been published on the disease. As the name implies, the disease affects only the kernel of the pecan and its presence can only be detected by removing the shell. The spot on the kernel is irregular in outline, dark brown or black in color and usually somewhat sunken. It varies from one eighth to one half inch in diameter. When the kernel is cut the brown area is found to extend into the meat to a depth of perhaps one eighth of an inch. The affected spot is bitter and imparts a bitter flavor to the rest of the meat.

The disease appears to be of general occurrence throughout the pecan belt, though ordinarily only a small percentage of the nuts are attacked. Occasionally, however, as in 1916, it becomes of very serious economic importance, causing the loss of thousands of dollars to the growers.

The green soldier bug, *Nezara viridula* (Linn.), is present throughout middle and southern Georgia, being of common occurrence every year and occasionally, as in 1916, becoming exceedingly numerous. The bug appears to attack cow peas in preference to all other plants, either cultivated or wild, when these are available. In the fall, when the pea vines begin to dry up, the bugs leave them and gather on any other plants or trees which they may find in the vicinity.

A very common practise among pecan growers is to sow peas in the groves during the early summer, the vines to be turned under, later, as a soiling crop. As a result, when the vines begin to dry up, usually in September or early October, the bugs leave them and collect on the pecans.

It was noticed, during 1916, that there occurred both a severe infestation of *Nezara viridula* and a severe outbreak of kernel spot. While it was entirely possible that this was a mere coincidence several growers noticed it, together with the fact that the disease appeared to be serious only in the groves in which cow peas had been sown. Moreover, in at least one case, bugs were observed feeding on the nuts.

As a result, during the past season preliminary experiments were conducted in which specimens of *Nezara viridula,* taken on cow peas, were confined on pecan nuts. The bugs fed on the green nuts, living on them for as much as a month, in three cases. Examinations made after the nuts had fully ripened showed that every nut in the several cages was severely infested with kernel spot, as many as five distinct spots occurring on a single kernel. Of several hundred nuts from the same tree, not confined in cages, only two or three had spotted kernels.

It has not been possible, thus far, to determine whether the fungus, *Coniothyrium caryogenum,* is present in the spotted areas, or not. In any case the data obtained are strongly indicative of the fact that *Nezara viridula* is an important agent in either the actual production or the dissemination of this disease. This is of particular interest since it is another of the observations, becoming more and more frequent during recent years, on the economic importance of a large group of insects (several families of the Heteroptera and the Cicadellidæ and Aphididæ among the Homoptera). Formerly these insects were recorded as injuring vegetation only when abundant, through the purely mechanical process of removing sap from the tissues. Of late, however, we are beginning to realize that many of them are of far greater importance than had been realized, both as the primary causative agents of specific plant maladies and as vectors and intermediaries in the dissemination of other specific maladies of bacterial or fungoid origin.

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[1] Rand, F. V., *Jour. of Agr. Res.*, Vol. 1 (1914), No. 4, pp. 330–334.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION E—GEOLOGY AND GEOGRAPHY. II

Preliminary report on experiments relating to continental deformation: R. T. Chamberlin and J. T. Richards.

The previous paper dealt with faulting, which may be regarded as a local, superficial phenomenon of continental masses; the present paper relates to the deformation of these greater masses. To attack this greater problem it seemed desirable to devise a mode of compressing blocks that have the shape of a continental sector of the earth with radial sides and superficial curvature. A machine for such sector crushing was built with movable steel jaws hinged below and corresponding in position to radii of the sphere. Into this a triangular wedge-like mass was molded with a surface curvature similar to that of a continent. By the use of a powerful jack, this representative of a continental sector could be squeezed by varying pressures reaching up to many hundreds of pounds per square inch. For experiments upon materials of uniform strength, pure paraffine was used; for experiments embodying the principle of increasing strength of materials with increasing depth below the surface in accordance with Dr. Adams's deductions from his experimental researches, there were molded, one above another in a series of zones of predetermined resistance, mixtures of plaster and paraffine in definite proportions. In all these experiments the prevalent type of faulting was that of a triangular wedge. This particular shape appears to be very significant, as has been suggested before. This wedge faulting naturally enough appeared first in the surficial portion of the sector; later after some relief had been realized above, and movement below had become less restrained, additional fracturing set in below. When paraffine alone was used, the numerous rough spots of the enclosing steel side-plates made trailing scratches on the soft material. These scratches served as autographic records of the different directions of internal movement of the material in reshaping itself into the separate wedges which came to divide the sector. As the scratches in many cases curved sharply, they indicated not only the various directions of movement of the separate portions of the sector, but also *the order of succession* of the individual movements that entered into the formation of each block. Further experimentation along these lines seems likely to throw some light upon the internal adjustments of masses within the earth while undergoing diastrophism.

Origin of the stylolitic structure in Tennessee marble: C. H. Gordon.

The marble known commercially as the Tennessee marble comes from what is known as the Holston formation, which is of Ordovician age. The producing areas occur chiefly in the central portions of the East Tennessee Valley region with Knoxville as a center. The marbles are sub-crystalline to more or less completely crystalline in texture and vary in color from light pink and gray to differing shades of red, dark chocolate and cedar. At the present time the light pink and gray are the leading varieties. One of the striking features of these marbles is the presence of thin, dark-colored interlocking seams or sutures known technically as stylolites. In the main these extend approximately parallel with the bedding or grain of the stone but not infrequently they are more or less inclined to this and at times cut the rock in all directions. The theories proposed to account for stylolitic structure are briefly considered and the solution theory accepted as being the most satisfactory. The chief question involved is as to whether these represent actual parting planes as heretofore usually considered, or fractures. It is the conclusion of the writer that while many of the sutures, especially in the more impure portions of the formation are undoubtedly parting planes, those in the massive light-colored stone have been formed along fractures instead of bedding planes. From the high content of carbonate of lime (98½–99 per cent.), the rich profusion of organic remains, chiefly bryozoa and crinoids, the irregularity in development, and certain features indicative of disturbed conditions in sedimentation, it is suggested that accumulation of the deposits took place in clear but shallow waters on reefs or banks where colonies of the types represented established themselves and grew in rich profusion. If reefs were present they were bryozoa reefs and not coral reefs, as no undoubted corals have been observed in the formation.

Report on the discovery of ancient glaciation on Mauna Kea, Hawaii: Wm. Alansen Bryan.

Reporting the discovery in July, 1916, of an ancient mountain glacial field fifty square miles in extent on the summit of Mauna Kea (13,825 feet), the highest mountain in the Pacific Ocean, together with an account of a subsequent ascent of Mauna Kea, Hualalei, and Mauna Loa for the purpose of securing comparative data for the determination of the relative age of these three important subtropical mountain summits.

Conditions of deposition of marine salts and their bearing on the potash problem: A. W. GRABAU.

The three theories which have been developed to explain the widespread occurrence of salt deposits in the past are: (1) The bar theory of Ochsenius. (2) The cut-off theory and, (3) the desert salt theory of Walther. (1) According to the first a constant supply of sea water is derived from the neighboring sea or large salt-water body. It is illustrated by the Karabugas Gulf. Such deposits are characterized by basal gypsum beds, an abundance of organic remains in the intercalated mud layers and by normal marine deposits of the same age in the neighboring sea from which the salt water was supplied. Mother liquor salts can only be developed as the result of a final cutting off of the basin and complete evaporation. (2) Salts deposited in a basin filled with normal sea water and cut-off from the sea, will be characterized by a basal gypsum or anhydrite layer, by an absence of organic remains except at the base, by the concentration of the salts into the deeper lying portion of the basin and by a regularity of the resulting series of salts. Such salt deposits may be enriched by additions from connate sources, with the result that the sodium chloride will be in excess of the other salts. Mother liquor salts are normally deposited in such a drying basin. The Stassfurt salts are believed to have had this origin. (3) Marine salts enclosed as connate sea water and salts, may be concentrated in desert basins far from the sea. They are characterized in general by the absence of a basal gypsum or anhydrite bed, though these salts may occur sporadically. Irregularity of deposition, lens-like character of the individual beds, and an absence of marine organic remains are among the other criteria of such a deposit. Moreover contemporary marine deposits are not necessarily formed in the immediate neighborhood of the salt basins. Mother liquor salts are generally and perhaps normally absent from such deposits, this applying especially to the potash salts which will be adsorbed by the soil through which the drainage waters pass before reaching the evaporation basin, while those that do reach this basin are apt to be dissipated as shown by Walther. The Salina salts of North America are believed to have had such an origin.

The Ordovician terranes of central Vermont: CHARLES H. RICHARDSON.

The author tersely gives the early geological history of central Vermont, from Algonkian time to the close of the Ordovician. He describes the Cambrian sedimentaries that flank the Ordovician on the west and form the eastern foot hills of the Green Mountains. The paper describes the Irasburg conglomerate which marks the base of the Ordovician terranes in central Vermont and the line of an erosional unconformity between the Cambrian and the Ordovician already followed for more than 100 miles in Canada and Vermont. It shows that the boulders in the conglomerate are all pre-Ordovician and the matrix Ordovician. The author then gives the general distribution of the three belts, non-continuous, of the Memphremagog slates, their composition and economic possibilities. This is followed by a description of the three belts of the Waits River limestone which are continuous and have been followed southward from the international boundary for 100 miles. These formations include the numerous beds of Waits River and Washington marbles which are catalogued as marble reserves. A short discussion is included of the intrusives in both the Cambrian and Ordovician terranes with a citation of about 20 different types of igneous rocks that have already been identified in these formations. The author lays stress upon the paleontology of the area because central and eastern Vermont were regarded as devoid of all fossil content prior to his discovery of numerous beds of graptolites in both the Memphremagog slates and the Waits River limestones. These graptolites have already been discovered in every township south of the international boundary near the central north and south line in the state for a distance of approximately 100 miles. They are present in each of the three phases of the Memphremagog slates and in each of the three phases of the Waits River limestone. Their presence proves sedimentation began in central Vermont in early Ordovician time (Beekmantown) and closed with the lower Trenton. The graptolites have been identified by Dr. Rudolf Ruedemann, State Paleontologist, Albany, N. Y.

Postglacial continental uplift: HERMAN L. FAIRCHILD.

The influence of the Ontario dome on the development of the Tertiary drainage of western New York, Ontario and Michigan: AMADEUS W. GRABAU.

The author has previously outlined the series of domes and basins which had their maximum development in eastern North America during the Appalachian revolution, but which had initial developments preceding that. The Paleozoic strata from which the cuesta topography of New York and Ontario was carved were not coastal plain strata to the Canadian shield as often assumed,

but had their source in the Appalachian Old-land on the southeast. Most of the limestones probably extended across the Ontario dome region which now shows only crystallines. These were exposed after the doming by the peneplanation which the region suffered in post-Paleozoic time. Renewed slight doming of this region in early Tertiary times caused the development of a cuesta topography which has no relations to the original old-land, indeed the cuestas point away from that old-land. These cuestas are in reality renewed hog-backs of the type developed around the Black Hills dome but the strata dip away from the center of the dome at a very low angle. The radial arrangements of the old river valleys now in part occupied by the Finger Lakes of New York and the Tertiary consequent streams of Ontario and Michigan further illustrate the effect of this dome.

The change of content of gasoline vapor in natural gas with age of the wells: O. J. Sieplein.

Natural gas which has been in contact with petroleum has taken up gasoline vapors from the petroleum. These can be condensed by pressure or by use of solvents. Gasoline vapor is probably one hundred times as valuable as the same volume of gas. As the well-pressure decreases, a larger quantity of gasoline is associated with the gas. An increase of 0.07 in specific gravity means an increase of one gallon of liquid gasoline from a thousand cubic feet of raw gas. Pumping of old oil wells as gas wells makes it possible to extract a large quantity of gasoline from that petroleum which is retained by the oil-sands and is not to be recovered by ordinary methods of producing petroleum.

A large high-pressure carbon dioxide well: L. G. Huntley and Roswell H. Johnson.

The so-called "air blasts," a peculiar geological phenomenon in the Kolar gold field, India: E. S. Moore.

The Kolar Gold Field, situated near Bangalore, Mysore, in southern India, has long been the most important gold-producing area of India. In this field a quartz vein carrying high values in gold to great depths, cuts a band of hornblende schists of pre-Cambrian age and these are in turn intruded by large dikes of basic igneous rock. Surrounding the area of schists and intruding it is a great mass of granite-gneiss resembling the Laurentian rocks of this continent. The "air blasts," which have received their name from the miners because of the rush of air which often accompanies large related disturbances, are explosions occurring in the walls of the workings on account of potential energy in the quartz, schist and dike rocks. This energy is permitted to act when mining operations relieve the pressure in certain directions. The source of this energy is believed to be found in the squeezing of the syncline of schist by the granite during compressional movements in the crust of the earth.

Pyrite in the coals of western Pennsylvania and its uses: Henry Leighton.

The enormous increase in the production of sulfuric acid since the war began, together with a curtailment of the importation of Spanish pyrite which, heretofore, was the source of 40 per cent. of the production, has brought about an earnest search for supplies in the United States. Among the sources of supply is the pyrite or marcasite occurring in coal beds as "sulphur balls." This material, during coal mining, is rarely saved, but if properly cleaned a good quality acid can be made from it. Among its good points is it freedom from injurious arsenic or phosphorus. By careful hand picking in the mine or on a picking table, much of this coarse material could be profitably saved under present conditions, while in washing coal for coke making, proper concentrating machinery could be installed for the recovery of a large amount of fine pyrite now wasted. An investigation of the pyrite resources of Pennsylvania is now being undertaken by the State Geologic Survey and indications are that much pyrite can be produced in the bituminous coal area, especially in the Pottsville and Allegheny series coals, around the north and northeastern margin of the bituminous field. Mercer, Jefferson, Clarion and Clearfield counties have in the past produced pyrite in small quantities and their production should be greatly increased.

Translations made accessible: Lancaster D. Burling.

By a system of reply postal cards, the request card of which enables a worker to inquire concerning the translation of any foreign paper in which he may be interested and of which he may be willing to share the expense if a special translation has to be made; the reply card properly filled out by the proposer of this scheme tells whether or not the paper sought has been translated, and if it has, where and how a copy may be obtained.

Factors determining the depth to salt water in wells: Roswell H. Johnson.

Problems in Green mountain geology: W. G. Foye.

Rollin T. Chamberlin,
Secretary